

What is claimed is:

- 1.** An article comprising;
a composite guiding region having at least three layers, wherein:
 - two of said three layers have stress of the same sign;
 - said two layers are separated by one or more interposed layers;
 - said one or more interposed layers have stress of opposite sign relative to said two layers; and
 - said interposed layers are suitable for guiding light based on the relative refractive indices of said interposed layers and said two layers.
- 2.** The article of claim 1, wherein at least one of said two layers comprises a first conformal layer.
- 3.** The article of claim 2, wherein said one or more interposed layers comprise a second conformal layer.
- 4.** The article of claim 1, wherein the magnitude of said stress of said two layers is substantially equal.
- 5.** The article of claim 1, wherein at least one of said two layers is stoichiometric silicon nitride.
- 6.** The article of claim 1, wherein at least one of said one or more interposed layers is chosen from the group consisting of silicon dioxide, silicon, polysilicon, phosphosilicate glass, borosilicate glass, and borophosphorous silicate glass.
- 7.** The article of claim 5, wherein one of said one or more interposed layers is silicon dioxide.

8. The article of claim 1, further comprising a layer of electro-optically active material, wherein said electro-optically active material is disposed on at least one of said three layers.

9. The article of claim 8, wherein said article is selected from the group consisting of a waveguide, an attenuator, a splitter, and an equalizer.

10. A surface waveguide comprising;
a lower cladding layer comprising a lower cladding material; and
a core comprising an inner core and an outer core, wherein:
 said inner core comprises one or more layers of inner core material;
 said inner core material supports propagation of light;
 said inner core material has a first stress;
 said outer core surrounds said inner core; and
 said outer core comprises an outer core material having a second stress of opposite sign relative to said first stress; and
 an upper cladding comprising an upper cladding material, wherein said lower cladding material and said upper cladding material have indices of refraction lower than the index of refraction of said outer core material.

11. The surface waveguide of claim 10, wherein one or more physical attributes of said inner core material and said outer core material, which physical attributes are selected from the group consisting of inner core layer thickness, outer core layer thickness, inner core stress level, outer core stress level, and type of material, are combined to provide a modal birefringence in said core of less than 0.0001.

12. The surface waveguide of claim 10, wherein said lower cladding material and said upper cladding material are individually selected from the group consisting of silicon dioxide, silicon, polysilicon, phosphosilicate glass, borosilicate glass, and borophosphorous silicate glass.

13. The surface waveguide of claim 10, wherein said inner core material and said outer core material are individually selected from the group consisting of silicon dioxide, silicon, silicon nitride, stoichiometric silicon nitride, silicon-rich silicon nitride, polysilicon, phosphosilicate glass, borosilicate glass, and borophosphorous silicate glass.

14. The surface waveguide of claim 10, wherein said inner core material is silicon dioxide.

15. The surface waveguide of claim 14, wherein said outer core material is stoichiometric silicon nitride.

16. A method of forming a surface waveguide comprising;
depositing on a surface of a substrate a first conformal layer comprising a first material having a first stress;
depositing on said first conformal layer a second conformal layer comprising a second material, wherein said second material has a second stress of opposite sign relative to said first stress;
depositing on said second conformal layer a third conformal layer of a third material, wherein said third material has a third stress of the same sign relative to said first stress.

17. The method of claim 16, wherein said first material and said third material are the same material.

18. The method of claim 16, wherein the magnitude of the stress of said first material and said third material is substantially equal.

19. The method of claim 16, wherein said first material is stoichiometric silicon nitride and said second material is silicon dioxide and said third material is stoichiometric silicon nitride.

20. The method of claim 16, wherein said first material is silicon dioxide and said second material is stoichiometric silicon nitride and said third material is silicon dioxide.

21. The method of claim 16, further comprising depositing an electro-optically active material on a layer selected from said first conformal layer, said second conformal layer, and said third conformal layer.

22. The method of claim 21, wherein said electro-optically active material is zinc-oxide.

23. The method of claim 16, further comprising removing at least a portion of the thickness of said first material in at least one region.

24. The method of claim 16, further comprising removing at least a portion of the thickness of said second material in at least one region.

25. The method of claim 16, further comprising removing at least a portion of the thickness of said third material in at least one region.

26. The method of claim 16, further comprising forming a topography on said surface prior to deposition of said first conformal layer of first material, said topography having a field region and at least one recessed feature.

27. The method of claim 26, wherein at least one of said first conformal layer and said second conformal layer substantially fill said recessed feature.

28. The method of claim 16, further comprising forming a topography on said surface prior to deposition of said first conformal layer of first material, said topography having a field region and at least one raised feature.

29. A method of reducing modal birefringence in a surface waveguide comprising;
forming a composite guiding region comprising an inner core of a first material
surrounded by an outer core of a second material wherein:
said inner core has a first stress; and
said first material supports propagation of light; and
said outer core has a second stress having opposite sign relative to said first stress;
and
said second stress compensates said first stress such that the modal birefringence of
said composite guiding region is less than 0.0001.

30. The method of claim 29, wherein said first material is silicon dioxide and said
second material is stoichiometric silicon nitride.

31. The method of claim 29, wherein said first material is stoichiometric silicon
nitride and said second material is silicon dioxide.

32. A surface waveguide comprising a composite guiding region having;
a first layer, wherein said first layer comprises stoichiometric silicon nitride;
a second layer, wherein said second layer comprises silicon dioxide and is disposed
on said first layer; and
a third layer, wherein said third layer comprises stoichiometric silicon nitride and is
disposed on said second layer.

33. The surface waveguide of claim 32, wherein said composite guiding region is
characterized by a cross-section having a width and a height, and wherein said width and
height are substantially equal.

34. The surface waveguide of claim 32, wherein the thickness of said first layer and
said third layer are substantially equal.

35. The surface waveguide of claim 32, wherein said first layer and said third layer
encapsulate said first layer of silicon dioxide.

36. The surface waveguide of claim 32, further comprising a fourth layer, wherein said fourth layer comprises silicon dioxide, and wherein said fourth layer conformally covers at least said third layer.

37. The surface waveguide of claim 32, further comprising a substrate, wherein said substrate includes at least one raised feature, and wherein said composite guiding region is disposed on said raised feature.

38. The surface waveguide of claim 37, wherein said substrate is silicon having a surface comprising silicon dioxide, and further wherein said raised feature is on said surface.

39. The surface waveguide of claim 32, wherein said first layer and said third layer have a thickness within a range of 10 nm to 350 nm, and wherein said second layer has a thickness within the range of 10 nm to 1850 nm.

40. The surface waveguide of claim 32, wherein said first layer and said third layer have a thickness of 250 nm, and wherein said second layer has a thickness of 300 nm.

41. The surface waveguide of claim 32, wherein said composite guiding region has a width within the range of 10 nm to 2000 nm.

42. The surface waveguide of claim 32, wherein said composite guiding region has a width of 800 nm.

43. The surface waveguide of claim 37, wherein said raised feature has a height within a range of 0 nm to 2000 nm.

44. The surface waveguide of claim 37, wherein said raised feature has a height of 800 nm.

45. The surface waveguide of claim 32, further comprising a layer of electro-optically active material, wherein said layer of electro-optically active material is deposited on at least one of said first layer, said second layer, and said third layer.

46. The surface waveguide of claim 45 wherein said layer of electro-optically active material is zinc-oxide.

47. A surface waveguide comprising;
a substrate having a planar field region and at least one recessed feature; and
a composite guiding region disposed in said recessed feature, said composite guiding region including a first layer of stoichiometric silicon nitride and a first layer of silicon dioxide; and
a second layer of stoichiometric silicon nitride.

48. The surface waveguide of claim 47, wherein said substrate includes a surface layer comprising silicon dioxide and further wherein said recessed feature is on said surface.

49. The surface waveguide of claim 47, wherein said first layer of stoichiometric silicon nitride and said first layer of silicon dioxide substantially fill said recessed feature, and further wherein said second layer of stoichiometric silicon nitride is conformally disposed on the bottom and sidewalls of said recessed feature.

50. The surface waveguide of claim 47, wherein the width of said recessed feature ranges from 40 nm to 4400 nm.

51. The surface waveguide of claim 47, wherein the width of said recessed feature is 800 nm.

52. The surface waveguide of claim 47, wherein the depth of said recessed feature ranges from 30 nm to 4400 nm.

53. The surface waveguide of claim 47, wherein the depth of said recessed feature is 550 nm.

54. The surface waveguide of claim 47, wherein said first layer of stoichiometric silicon nitride and said first layer of silicon dioxide are removed from at least a portion of said planar field region.

55. The surface waveguide of claim 47, wherein the thickness of said first layer of stoichiometric silicon nitride is 250 nm, the thickness of said first layer of silicon dioxide is 300 nm, and the thickness of said second layer of stoichiometric silicon nitride is 250 nm.

56. The surface waveguide of claim 47, wherein said second layer of stoichiometric silicon nitride is removed from at least a portion of said planar field region.

57. The surface waveguide of claim 47, further comprising a layer of electro-optically active material disposed on said second layer of stoichiometric silicon nitride.

58. The surface waveguide of claim 57, wherein said electro-optically active material is zinc-oxide.

59. The surface waveguide of claim 47, further comprising a second layer of silicon dioxide disposed on said second layer of stoichiometric silicon nitride.